Benthic foraminifera from the deep-water Niger delta (Gulf of Guinea): Assessing present-day and past activity of hydrate pockmarks

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Résumé en anglais	We present ecological and isotopic (δ18O and δ13C) data on benthic foraminifera sampled from 4 deep-sea stations in a pockmark field from the deep-water Niger delta (Gulf of Guinea, Equatorial Atlantic Ocean). In addition, a series of sedimentological and (bio)geochemical data are shown to back up foraminiferal observations. All stations are located within 1.2 km of each other, so prevailing oceanographic conditions can be assumed to be similar at each site. Two of the sites (GMMC-01 and GMMC-02) are located in a pockmark (named “pockmark A”) where current methane seepages were recorded by ROV observations. A third station (GMMC-03) is located in the topographic depression interpreted as a collapsed pockmark (named “pockmark B”). The fourth site (GMMC-04) is a reference station, without evidence of past or present seepages. Our observations show that degraded organic matter with low bio-availability is present at all stations with a preferential burial of organic compounds in topographic depressions (GMMC-03 station). Authigenic aragonite is abundant in surface sediments at stations GMMC-01 and -02. Its precipitation is likely related to high rates of methane oxidation during past seep events in episodically active pockmark A. In contrast, the absence of anaerobic methanotrophic Archaea (ANME) during the sampling period (November 2011) suggests that only moderate sulphide and methane oxidation take place close to the sediment–water interface. Compared to the reference site GMMC-04, living foraminifera at the collapsed and episodically active pockmarks show minor changes in terms of diversity, standing stocks and faunal composition. However, the δ13C signal of living and dead (but well-preserved) foraminiferal species (Ceratobulimina contraria, Melonis barleeanus, Uvigerina peregrina) is depleted in the episodically active pockmark A compared to the other stations. Overgrowth of authigenic carbonate on altered foraminifera generates an important shift to lower δ13C values. Dead faunas carry a complex time-averaged message, integrating taphonomic gains and losses related to the temporal variability of gas emission. They reveal major faunal differences that may be useful to detect gas hydrate seepages in different pockmark stages.
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